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SIDE-LAUNCHING OF SHIPS FROM A FREE FLOATING PONTOON

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Recently several ships with a launching weight of 400 tons have been launched into water by means of a special arrangement whose principal part is constituted by a free floating rectangular pontoon with a carrying capacity of 600 tons.

The ship-launching operations based on this arrangement consisted in the following.

The ships were built in a covered-in slip, hauled stern first to an open-air year behind the slip and transferred sideways (Figs. 1, 2) /pages 55 and 56 of Source/ onto a partly flooded pontoon set in a fixed position. The pontoon was towed by cutters to the launching site -- deep water, where the ships were launched sideways.

The elements of the launching arrangement and the operations related to the launching are described below.

The shipways in the building slip consisted of several rail bogies linked together by coupling bars, provided with build-in hydraulic jacks, and supporting the transverse keel-enclosing beams serving as supports for the ship under construction.

A number of timbers installed during the building period in accordance with the requirements of assembling technology were removed from underneath the ship before she was led out onto the open-air yard. The ship was left resting on a minimal number of supporting timbers, determined in accordance with the hull strength and the carrying capacity of the timbers themselves.

The open-air yard behind the building slip (Fig. 1) consisted of two horizontal and one inclined sectors. To lead out the ship from the building slip, rail-track groundways were laid on the upper horizontal sector, which has a rock foundation, flush with the building-slip ways. To transfer the ship onto the pontoon, the open-air yard is provided with four traversing rail tracks running through all three sectors of the yard and termination at the pontoon.

The lower horizontal sector was located half-way over the water's edge and consisted of four rows of pilings carrying, in their above-water part, the rail tracks. The four rows of pilings stretched out beyond the water's edge for 12 meters, thus providing a support for the pontoon.

The launching pontoon (Fig. 3) [Page 56 of Source] was represented by four-cargo barges with carrying capacities of 150 tons each, joined together by beams and cover plates, and adapted in this form for launching ships. The strength of the pontoon was fortified through local reinforcements in the form of stiffened cross members and stanchions mounted in the planes of the rail tracks, and additional couplings. The pontoon was subdivided by bulkheads into 12 watertight compartments: the four ballast compartments served for flooding with water, while the other compartments served as auxiliary ones for assuring the proper trim of the pontoon-ship system. The compartments floodable by water were executed in open form (without battening down their hatchways).

The filling of the ballast holds of the pontoon with liquid ballast and the draining of these holds is carried out by a combined water-pouring and -draining system on the pontoon, consisting of a piping (Dy = 120 millimeters) and a floating pump installation.

Prior to hauling the ship onto the pontoon, the latter was placed over the supporting basis [submerged part of piling rows], with its rail tracks positioned flush with the rail tracks on the quay. Thereupon the ends of these railtracks were joined together by removable side cover plates. The adjustment of the pontoon flush with the quay was carried out by pumping liquid ballast into the ballast holds.

The pump installation consisted of two pumps with a combined delivery capacity of 600 meters an hour, receiving branch pipes, distributing box, piping, and a control board, all mounted together on a small pontoon bridge. The branch pipes of the distributing box were joined to the piping on the pontoon by flexible hoses (Dy = 150 millimeters).

The leading out of the ship from the covered slip onto the open-air quay (Fig. 1) was carried out by the slip's overhead crane by means of trantion ropes measuring 20 millimeters in diameter. The ropes extended from the transverse crosshead of the bogie train through concrete-type tackle to the hook of the crane. The mutually coupled bogies were set in motion by raising the hook of the overhead crane.

On the open-air quay's upper horizontal sector the bogies were removed from under the ship by substitution of fixed wooden cages. The thus freed bogies were turned 90 degrees and adjusted for transferring the ship onto the pontoon. Thereupon the temporary wooden cages were removed from under the hull and the ship's weight was again left resting on the bogies. The transfer of the ship onto the pontoon (see Figs. 1 and 2) was carried out along four traversing rail tracks by means of the overhead crane. The ropes extended from the bogies on the second and fourth tracks through the tackle to the hook of the crane.

On each track the weight of the ship was supported by a keel-enclosing beam lashed to the ship's hull and transmitted through tilting bearings to the hydraulic jacks of two bogies. The tilting bearings ensured a smooth transfer of the ship from the upper horizontal sector onto the inclined sector and from the inclined sector onto the lower horizontal sector, in such a way as to avert hull fracture.

During the travel along the rail tracks, a fixed initial oil pressure was maintained in the cylinders of the hydraulic jacks of the bogies, so as to ensure an optimal position of the neutral axis of the ship's hull. This averted any possible hull fracture that might be caused by irregular sagging of the rail-track shipways.

While traveling down the slope the ship was restrained by the slip's other overhead crane by means of restraining ropes measuring 26 millimeters in diameter. The ropes extended from the bogies on the second and fourth tracks through tackles to the crane's hook. The movement down the slope was carried out through a simultaneous paying out of the restraining ropes and picking up of the traction ropes. In addition, to assure a smooth launching, the ship was held back by three "scrapers" (sand-filled metal boxes). The amount of the ballast (sand) was so selected as to cause the friction force created by the scrapers during the travel to exceed the component of the launching weight in the direction of travel down the slope by two to three tons, thereby ensuring slowed-down travel. The "scrapers" were attached to the rear bogies on the second, third and fourth tracks by ropes measuring 26 millimeters in diameter, and they started to operate at the moment of the passage of the ship from the upper horizontal sector to the inclined sector. For their movement along the rails the scrapers were provided with slideways.

The transfer of the ship onto the pontoon was carried out after several reslingings of the traction and res-

training ropes on the hooks of the overhead cranes.

On the second horizontal sector the scrapers were detached and a third pair of bogies was placed under every keel-enclosing beam (Fig. 2b). This ensured a more uniform transfer of the launching lead onto the rows of pilings, and approximated the conditions of launching on bogies to the conditions of launching on solid slipways -- without jarrings. After the installation of the third pair of bogies, the ship was hauled onto the pontoon and her sides were lashed tightly thereto. Arresting chocks were placed under the wheels of the bogies. At the same time, the bogies were attached to the keel-enslosing beams by rigid and flexible couplings; the launching trigger was installed and raised.

The launching trigger (Fig. 4) [page 57 of Source] is constituted by a system of levers raised on a coupled rope. The rope circuit includes a disengaging link in the form of a catch hook. Prior to the launching the trigger restrained the movement of the ship when the latter was freed from the lashing ropes and arresting chocks and when the pontoon had heeled over, by receiving the component of launching weight in the direction of travel if need be and making it possible to carry out the launching from any one listing side of the pontoon. A hawser extended from the release lever of the catch hook to the quayside. The trigger was activated manually by pulling at the hawser with a force of four or five kilograms.

After the ship was hauled onto the pontoon and fastened thereto, the rail cover plates were removed. Liquid ballast was then pumped out from the ballast holds of the pontoon.

After the ballast compartments were completely drained, the pontoon -- together with the ship it carried -- had risen in the water by about 100 meters; this was a distance sufficient for floating away without being impeded by the underlying supporting basis. The pontoon and ship rose on even keel. The trim of the pontoon-ship system was aligned, on the basis of prior calculations, by adding 70 tons of solid ballast during the period of assembling of the pontoon.

After the flexible hoses of the distributing box of the pump station were detached from the piping, the pontoon was towed by cutters to the deep-water launching site.

The stability of the pontoon-ship system during the towing was characterized by an initial metacentric height of 7.08 meters, and it was comparatively high because of the considerable width of the pontoon.

The following launching operations were carried out at the launching site (Fig. 5) [Page 57 of Source]. The pontoon, together with the ship, was moored by ropes tied to the quayside bollards: the pump installation was brought close to the pontoon and connected through flexible hoses to the pontoon's piping.

For safety's sake, the apparatus for controlling the pump installation was transferred onto the quay, so that the pumps were operated by remote control. The ship was freed from its lashings and restraining chocks, so that it was left only under the control of the trigger device. After the pontoon was vacated by the personnel working thereon, the pumps of the pump installation were turned on so as to pump water into the two ballast compartments on the port side of the pontoon.

In measure with the flooding of the compartments, the pontoon with the ship began to heel at an angle which reached two degrees after two minutes. The angle of heel of the pontoon was determined visually in accordance with the readings of a special panel in the forward part, which indicated the extent of listing of the pontoon.

After the above-mentioned angle of heel was reached by the pontoon, the trigger was activated by pulling at the hawser from the quayside. The thus released ship listed over and, gaining speed, rolled down from the pontoon (Fig. 6) [Page 58 of Source]. The pontoon recoiled to the opposite side, dragging with it the pump station joined to it by flexible hoses.

During the movement of the ship on the pontoon, the latter acquired a forced list which reduced the height of impact of the ship on the water surface. The stability of the pontoon-ship system at the commencement of the launching was characterized by a metacentric height of 5.9 meters, and it remained sufficiently high despite the presence of free surfaces. The maximal roll of the ship at the moment she slid down from the pontoon amounted to 35 to 40 degrees; the return angle of roll was 25 to 30 degrees; the maximal roll of the pontoon was seven to eight degrees; the period of launching lasted five to six seconds; the height of impact of the ship amounted to minus 0.25 to 0.30 meters. The lateral movement of the ship was eight to 10 meters. The comparatively small return angle of roll of the ship is to be explained by the presence of a 40-ton weight under the ship's hull -- the bogies and keel-enclosing cross beams.

After the launching the cross beams and bogies were removed from under the ship by means of a crane, and the

pontoon together with the pump station was towed back to its resting place -- on the underwater pilings.

Conclusions

1. The launching arrangement described in the present article, which is very economical in terms of cost and time, can be recommended for cases in which the shallowness and unsuitability of the waterfront of a shipyard do not make it possible to carry out within a short period of time and without high capital expenditures the construction of any tried and tested arrangement for the side launching of ships.

2. The launching of ships from a free floating pontoon can find application under definite conditions, and it is also of theoretical interest, because it is a further development of the existing methods of side launching and represents a more general and, at the same time, more complex method requiring theoretical and experimental investigation.

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